

# The Climate is A-Changin': Teaching Civic Competence for a Sustainable Climate

Carolyn A. Harris, Pushker Kharecha, Pam Goble, and Ryan Goble



*Thoughts from one of Earth's "climate doctors" ...*

**Diagnosis:** "We think something is wrong. We can detect that the temperature is warming and lots of things are changing..."

**Prognosis:** "What we can predict is that things are going to get worse."

**Treatment:** "Think about ways to reduce carbon emissions."

—Gavin Schmidt,  
NASA Goddard Institute for Space Studies<sup>1</sup>

A central aim of social studies curriculum is to prepare young people for making "informed and reasoned decisions for the public good" concerning consequential problems like global climate change.<sup>2</sup> By developing students' "vision of a good society" and exploring what actions and policies move our society in this direction, social studies teachers have an important role in preparing students for a world undergoing enormous environmental change.<sup>3</sup> This article discusses elementary curriculum connections between building students' knowledge and understanding about "their community, nation and world" and global climate change. It also suggests ideas for building civic competency and climate literacy while creating opportunities for students to practice high-value skills like "data collection and analysis, collaboration, decision-making and problem-solving."<sup>4</sup>

## Prominence of Climate Change in Civic and Global Life

Throughout human history, the world's climate has played a major role in shaping life and culture. A place's climate is

described by the average weather conditions there during a period of time (usually at least several decades)—for instance, precipitation, temperature, wind, humidity, and the composition and pressure of the air. These factors are closely related to the geography of the physical landscape and location on the Earth.

The climate produces amazing environmental diversity from the tropical rainforests in Brazil, to arctic forests in Russia, to arid deserts in Egypt, to temperate mid-Atlantic cities like New York. Climate greatly influences people's lifestyle, work, development, prosperity and wellbeing.

More than 97 percent of the world's climate scientists agree that scientific evidence, accumulated over decades of research, shows that Earth's average temperature has increased significantly over the last 150 years (and rapidly over the past several decades), and that human activities are the primary cause of this rise.<sup>5</sup> Two types of human activities have the greatest impact on climate change: the burning of fossil fuel and the various uses of land. Multiple lines of evidence show that carbon dioxide (CO<sub>2</sub>) emissions from the burning of fossil fuels (coal, oil, and natural gas) are now the main cause of long-term global climate change.<sup>6</sup> In short, the massive industrial activity of the 20th century has brought us to the point where our actions are now the main cause of the rise in temperature of Earth's atmosphere, land, and oceans. For example, volcanoes emit CO<sub>2</sub> each year, but the burning of fossil fuels today produces over 150 times more CO<sub>2</sub>.<sup>7</sup>

Climate scientists overwhelmingly agree that if left unchecked, the impact of human-caused climate change will become increasingly disruptive to humans and to natural ecosystems. However, there remains a basis for optimism: we know how to essentially fix the global problem of climate change—we need to use alternative (non-fossil) energy sources and improve land-use practices.

## Keeping Afloat in a Sea of Controversy

Climate change is at once a fascinating, complex, and alarming topic for elementary students. It can also be controversial because of differences concerning solutions. Since 2012, NASA

Goddard Institute for Space Studies (GISS) and Columbia University’s Earth Institute (EI) have been conducting the Climate Change in the Classroom (CCIC) workshop to support teaching about climate change.<sup>8</sup>

As scientists and educators, we have been developing free online professional development programs and curricular materials to help teachers improve students’ climate literacy and civic competence. Our aims are for students to develop scientific knowledge, global awareness, and problem-solving and critical thinking skills to inform their participation in climate change discussions and decision-making processes. The skills necessary to engage in discussions about climate change and to propose and take informed action to solve problems are transferrable to the growing number of contemporary issues that, like climate change, are complex, global in scope, and require scientific and multidisciplinary understanding.

CCIC provides a unique collaborative space for teachers to work with colleagues from diverse disciplines, as well as leaders in science, education, and the media to advance real world learning opportunities. According to Nicole Dodendorf, a teacher from Illinois’ Carol Stream Community School District 93, “The CCIC experience and Hot materials helped me create opportunities for students to critically think about climate change through multiple discipline lenses, discover the impacts on life and our mutual interests in solutions.”

Social studies teachers can stretch students’ thinking through problem-based learning, where they are compelled to think deeply about why issues like climate change matter and how they can be solved. In a unit of study on climate change, students can draw on and apply learning from science, mathematics, and technology to make sense of the causes and magnitude of climate change, and to explore, design, and debate solutions.

### Curriculum Connections

An analysis of climate change addresses numerous social studies themes, including ● CULTURE; ● TIME, CONTINUITY AND CHANGE; ● PEOPLE, PLACES, AND THE ENVIRONMENT; ● SCIENCE, TECHNOLOGY, AND SOCIETY; and ● GLOBAL CONNECTIONS.

During the elementary school years, children begin to develop qualitative and quantitative ideas about weather and climate and the factors that enable living things to survive and thrive. They have the ability to see the world through a climate scientist’s lens; that is, to see Earth as a system of interrelated parts—land, water, air—as well as the living things that dwell in these three dynamic spaces.

Equally important is providing students with the opportunity to see climate change through a social studies lens so that students think about climate in the context of behaviors and policies in their own community, as well as the nation, and other regions around the world.

Teaching about climate change dovetails with the inquiry-based teaching approach at the heart of the *College, Career, and Civic Life (C3) Framework for Social Studies State*

*Standards*. The essential question, “How does climate influence culture, and culture influence climate?” frames students’ research about the causes and effects of, and possible solutions to, climate change. The overall goal is to move students from learning about the multifaceted nature of the climate change; to envisioning possible climate solutions and greener communities,<sup>9</sup> to taking informed action (Dimension 4 of the C3 Framework).

### Dimensions of the C3 Framework’s Inquiry Arc

1. Developing Questions and Planning Inquiries
2. Applying Disciplinary Concepts and Tools
3. Evaluating Sources and Using Evidence
4. Communicating Conclusions and Taking Informed Action.

### Analyzing the Data

Having students read grade-level-appropriate news articles gives teachers the opportunity to engage students in discussions and develop their critical reading skills. Two *USA Today* articles are useful for beginning a classroom discussion about Climate Change in the fifth or sixth grade: “The Heat Goes On: June was the Hottest on Record” and “Carbon Dioxide Levels Reach Global Milestone.”<sup>10</sup> Students should consider these questions:

- What do we know about recent climate change?
- How do we know what we know about climate change?
- What arguments are made in the articles?
- Do the data support the claims?
- Can we identify information that is factual, as opposed to an opinion or speculation?

Analysis of scientific data summarized in charts and graphs develops students’ skills, too. Below are two of the most popular climate change graphs featured on global media.

**Figure 1** shows the Earth’s average surface temperature increasing since the Industrial Revolution in the 1880s. (The plotted values represent differences from the average temperature for the period 1951–1980.)

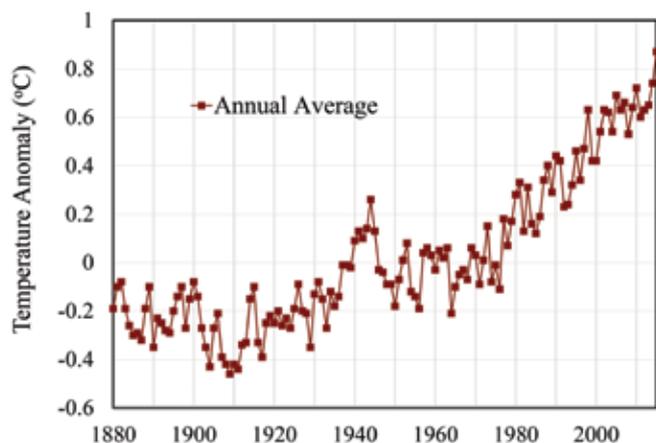
**Figure 2** shows that CO<sub>2</sub> in Earth’s atmosphere has been increasing in recent decades.

Looking at these two graphs by themselves does not tell the full story about climate change. However, when considered along with many other lines of well-established research, these data add to very strong evidence that carbon dioxide (specifically, from human activities) is the single biggest cause of recent global climate change.

Being able to interpret and use graphical information is an essential civic literacy skill and part of Dimension 3 in the

Figure 1

### Global Surface Air Temperature Change (1880–2015)



(GISS Surface Temperature Analysis. “Global Annual Mean Surface Air Temperature Change,” NASA Goddard Institute for Space Studies. [data.giss.nasa.gov/gistemp/graphs\\_v3/](http://data.giss.nasa.gov/gistemp/graphs_v3/). This line plot shows annual mean changes in temperature relative to the average temperature for the period 1951–1980, which is set at zero on the y axis.)

C3 Framework. An entire lesson can be devoted to the critical investigation of the two graphs above and would model the real-world work of scientists. Some questions that students might consider include:

- What data are being measured?
- How do you think the data were collected?
- What geographic area and time period do the data cover?
- What patterns and trends do you notice?
- What questions do you have?

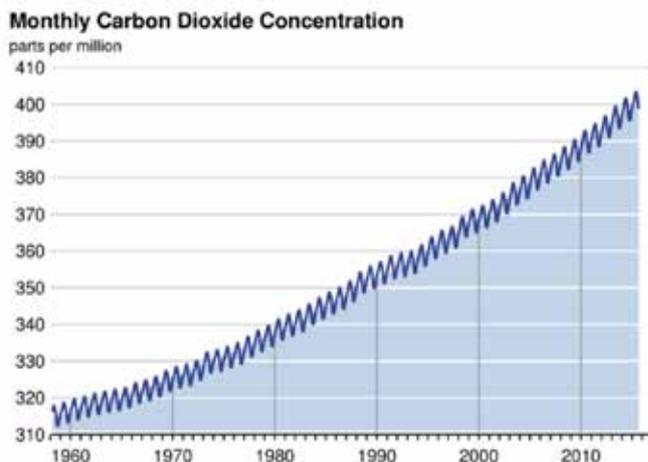
Students should be encouraged to ask their own questions and develop their own inquiries (Dimension 1 of the C3 Framework), which may include searching for the sources of carbon dioxide or the causes of variations shown in the graphs. As students dig deeper, one particularly excellent source, appropriate for the elementary level, is the U.S. Environmental Protection Agency’s website, “A Student’s Guide to Global Climate Change.”<sup>11</sup>

### Using Role Play

Once students begin to think about scientific data and climate change, they may be ready to examine its potential effects on people’s lives, as well as what might be done to forestall those effects. The book, *Climate Change: Picturing the Science*, provides an apt quote to stimulate students’ discussion: “Our climate has influenced where we have built our cities, where we plant our crops, how we travel, what we eat and sometimes, how we die.”<sup>12</sup> Students can generate examples and evidence that support the statement. That discussion bridges to the next

Figure 2

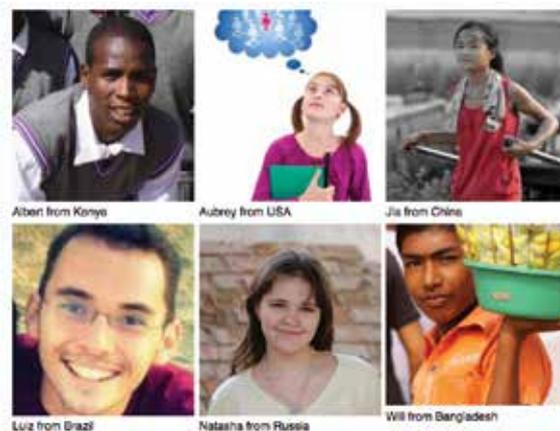
### CO<sub>2</sub> Concentration at Mauna Loa Observation, Hawaii



(Scripps CO<sub>2</sub> Program. “Atmospheric CO<sub>2</sub> at Mauna Loa Observatory,” Scripps Institution of Oceanography, UC San Diego. <http://scrippsco2.ucsd.edu>)

part of the unit: a role-play involving six young people from different regions of the world.

Examining the impact of climate change on individuals around the world can have a powerful impact on students, enabling them to consider not only local implications for climate change, but national and global implications as well. Students work in a group, and each group is assigned one of six roles — youth from around the world whose lives are impacted by climate change: Natasha from Russia; Luiz from Brazil; Will from Bangladesh; Albert from Kenya; Aubrey from the United States; and Jia from China. Their one-page biographical summaries are available free online as student handouts.<sup>13</sup> Included in each bio are three dimensions that influence that young person’s life, thinking, and actions: (1) a regional perspective, (2) a unique skill set, and (3) knowledge about an energy technology that could help slow or reduce climate change.



Playing their assigned roles, students participate in a panel discussion on the impact of climate change and propose possible solutions from each of the six perspectives. Students can take notes about their discussions.

## Evaluating Solutions and Taking Action

To initiate a conversation about solutions to climate change, students can watch the video, “The Big Climate Change Experiment: Calling All Climate Doctors,” featuring NASA GISS Director Gavin Schmidt.<sup>14</sup> Guided by teachers, students can use the information presented in the video to reflect on, reinforce, deepen, and synthesize their learning from the previous lessons; they can also discuss the video’s medical analogy (referenced at the beginning of this article) for climate change.

Students then work with their groups to identify and discuss the skill sets of the young people whose roles they are playing. Because one goal of social studies is to gain insight into the various people who can influence local, national, and global decision-making, students use their skills to connect with people whom they think may be able to affect climate change solutions. These people might include: scientists who advance our knowledge about climate, engineers who design technological solutions, journalists who communicate ideas and inform the public, government officials who make laws and regulations, and individuals who—as consumers—make choices that affect the environment and—as citizens—affect public policy by voting, organizing, and lobbying.

As a culminating activity, students identify the energy solution best associated with the global youth role that they were assigned. Students research their climate change energy solution (again, the U.S. EPA website can be a good reference) and share their views as to the pros, cons, and challenges of implementing various actions. Teachers may offer students the opportunity to form groups to advocate for the solution(s), using persuasive, creative, and evidence-based arguments. These activities model taking informed action (Dimension 4 of the C3 Framework).

## Conclusion

There is virtually unanimous consensus among the world’s climate scientists that continuing our present path of human-induced climate changes “has the potential to create dangerous consequences for human society...”<sup>15</sup> Thus, climate change is an important topic for students to investigate in a social studies classroom. While decisions on what to do about climate change are fundamentally political and economic, a scientific lens is an important component for informing our decisions. The elementary curriculum can provide students with multidisciplinary lenses—scientific, historical, civic, economic, and geographic—to begin forming ideas about the implications of our growing human footprint on the environment and developing the civic competency to ensure a sustainable climate for this and future generations. 🌍

## Notes

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7. U.S. Geological Survey, “Volcanic Gases and Climate Change Overview,” [volcano.usgs.gov/hazards/gas/climate.php](http://volcano.usgs.gov/hazards/gas/climate.php).
8. This article is based on a free online resource: NASA GISS, “Climate is A-Changin’: Teaching Civic Competence for a Sustainable Climate,” [www.giss.nasa.gov/edu/ccic/nodes/node24.html](http://www.giss.nasa.gov/edu/ccic/nodes/node24.html). The CCIC homepage is [www.giss.nasa.gov/edu/ccic](http://www.giss.nasa.gov/edu/ccic).
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12. Gavin Schmidt and Joshua Wolfe, *Climate Change: Picturing the Science* (New York: W.W. Norton, 2009), 2.
13. NASA GISS, “Student Roles,” [www.giss.nasa.gov/edu/ccic/nodes/node17.html](http://www.giss.nasa.gov/edu/ccic/nodes/node17.html).
14. Gavin Schmidt, “Lecture 1: Medical Analogy for Climate Change,” *Climate Change in the Classroom*, [www.giss.nasa.gov/edu/ccic/nodes/node24.html](http://www.giss.nasa.gov/edu/ccic/nodes/node24.html).
15. Schmidt and Wolfe, 9.

**CAROLYN A. HARRIS** is Education Coordinator, Columbia University and NASA Goddard Institute for Space Studies (GISS) in New York, New York

**PUSHKER KHARECHA** is a Research Scientist, Columbia University and NASA GISS in New York, New York

**PAM GOBLE** is Adjunct Professor of Education at Aurora University and Benedictine University in Illinois and a former English and social studies teacher

**RYAN GOBLE** is Teaching and Learning Coordinator at Glenbard High Schools Township District 87 in Illinois and a doctoral candidate at Teachers College Columbia University, New York, New York